sistency in the results therein shown, may be attributed to a more perfect system of observation in vogue in some of the states. Thus, in New Hampshire the average interval of excessive monthly precipitation is given as two years, while in the adjoining state of Vermont the interval is fifteen years. This discrepancy is doubtless due to the more complete reports from New Hampshire, the observations taken at several points by the Lake Winipiseogee Cotton and Woolen Manufacturing Co. constituting an exceptionally accurate and valuable record extending over many years. Aside from this most marked exception it will be seen that, as a rule, there is a remarkable uniformity shown in the average interval of monthly excessive rainfalls in contiguous states and territories, the interval being smallest in Oregon, where it is only eight months, and only slightly greater in the Gulf States, North Carolina, and Washington, where it averages about one year. Exclusive of Vermont, the greatest average interval of excessive monthly rainfall, fifteen years, is shown for Montana, while in Dakota, Michigan, and Minnesota it is seven and eight years, respectively.

In the column of rainfalls of ten inches, or more, per month, it will be seen that by far the greatest number of excessive monthly rainfalls (482) have been reported in California, where stations are numerous, and that none have been noted in Idaho, Nevada, Utah, and Wyoming, where, while stations are comparatively few and scattered, it is not probable that rain has fallen in amounts to equal or exceed ten inches in a month. Following in order of greater frequency are, Florida with 344, and Georgia, North Carolina, Oregon, and Texas, with more than 200, while in Arizona, Colorado, Montana, New Mexico, Vermont, and West Virginia, the instances of their reported occurrence are very limited in number.

The greatest number of daily excessive rainfalls, 556, have been reported in Texas, while in Idaho and Nevada none have been noted. In North Carolina, Georgia, and Florida over 300 instances have been reported in which 2.50 inches, or more, of rain have fallen in twenty-four hours, while in Alabama, Illinois, Iowa, Kansas, Louisiana, Maryland, Massachusetts, Mississippi, and Tennessee excessive daily rainfalls have been noted in more than 200 instances. In Arizona, Colorado, Montana, New Mexico, Utah, Vermont, West Virginia, and Wyoming the number of excessive daily rainfalls recorded is less than 20.

Excessive hourly rainfalls have been reported in the greatest number of instances, 168, in Texas, and none have been noted in Idaho, Nevada, Oregon, Utah, and Washington. They have been reported in more than 100 instances in Florida, Iowa, Kansas, and Nebraska, while in Arizona, California, Colorado, Connecticut, District of Columbia, Indian Territory, Kentucky, Maine, Massachusetts, Minnesota, Montana, New Jersey, New Hampshire, New Mexico, Ohio, Rhode Island, Vermont, West Virginia, Wisconsin, and Wyoming, excessive hourly rainfalls have been noted in less than 20 instances.

Over portions of the Rocky Mountain region where monthly rainfalls equalling or exceeding ten inches have not been reported, the largest monthly rainfalls noted in the several states and territories have been published in the tables of excessive precipitation in the REVIEW during 1888.

WINDS.

The prevailing winds during January, 1889, are shown on chart ii by arrows flying with the wind. In the Atlantic coast states north of the thirty-seventh parallel; over a greater portion of the Lake region; in the upper Mississippi, Missouri, and Ohio valleys, and along the south Pacific slope, the winds were mostly westerly. In the south Atlantic and Gulf states, and over the eastern slope and plateau regions of the Rocky Mountains, they were variable. On the north Pacific slope they were from south to east, while along the middle Pacific slope northerly winds were most frequently noted.

HIGH WINDS (in miles per hour).

Maximum velocities of fifty miles, or more, per hour, other than those given in the table of miscellaneous meteorological data, have been reported as follows: Wood's Holl, Mass., 57, s, 9th; 50, nw., 19th; 54, se., 21st. Buffalo, N. Y., 52, sw., 16th and 17th; 52, w., 21st. Block Island, R. I., 54, e., 5th; 54, nw., 10th; 60, se., 21st; 52, e., 27th. Fort Elliott, Tex., 52, nw., 8th. Fort Canby, Wash., 50, se., 3d. Valentine, Nebr., 52, nw., 8th; 54, n., 30th.

LOCAL STORMS.

Descriptions of severe local storms which attended the passage of low area iii are given under the heading "Areas of low pressure," and the following reports refer to disturbances occasioned by the passage of depressions traced on chart i.

5th. *Virginia.*—Lynchburgh: a severe wind and rain storm occurred during the early morning. It came from the east and did some damage in this city and vicinity. Maximum velocity of wind, thirty-six miles per hour from the east, at about 6 a. m. Rain continued during the day, 1.26 of an inch being measured at the morning and 0.52 at the evening observation.

6-7th. *New York.*—New York City: the high northeasterly shifting to westerly winds were very destructive in Brooklyn; six houses in course of erection, and numerous trees and fences in that city were blown down. Watertown: reports show that the sleet storm which prevailed during these dates destroyed thousands of valuable shade, fruit, and forest trees in Jefferson and Saint Lawrence counties. The telegraph and telephone wires were heavily coated with ice and broke under its weight, seriously interrupting communication.

20-21st. *Massachusetts.*—Boston: heavy snow and high wind prevailed during the night. The wind blew a gale of forty to fifty miles per hour for five hours, and attained a maximum velocity of fifty-four miles per hour at 2 a. m., 21st. The storm was very severe in this vicinity; several lives were lost and considerable damage was caused to shipping.

21st. *North Carolina.*—Hatteras: storm began from the southwest 2.55 a. m. and ended 3.10 a. m.; maximum velocity of the wind thirty-five miles per hour. The life-saving station at Cape Hatteras reports five men drowned, one barkentine and one three masted schooner sunk, and other vessels disabled on Hatteras shoal during the gale.

WATER-SPOUTS.

"The San Pedro (Cal.) Advocate," of January 19, 1889, states that two water-spouts were observed off San Pedro 15th; one on the east side of the bay near Anaheim Landing, and the other in the vicinity of Catalina Island. They were funnel shaped, the larger end in the cloud, and the smaller end in the water. They moved rapidly and broke before reaching the coast.

INLAND NAVIGATION.

ICE IN RIVERS AND HARBORS.

Albany, N. Y., 23d: the Hudson River froze over for the first time this season this morning.

Buffalo, N. Y.: the lake, open to the 28th, was covered with ice on that date as far as could be seen from this place.

Cleveland, Ohio: a transfer ferry-boat for use at Detroit,

Mich., left here during the night of the 13–14th. A mid-winter trip of that kind is unprecedented in lake navigation.

Pittsburgh, Pa.: floating ice in both rivers 21st to 24th, and floating ice in the Allegheny River, 28th to 31st.

Alpena, Mich.: Thunder Bay and Thunder Bay River, which had been free from ice since the commencement of the month, were partly frozen over on the 12th.

Keokuk, Iowa: The Mississippi River was full of floating ice on the 17th.

Leavenworth, Kans: floating ice in the Missouri River, 1st to 6th, 10th, 11th, 14th, 17th, 18th, 20th, 21st, 27th to 29th.

FLOODS.

Little Rock, Ark.: owing to heavy rains the Arkansas River rose very high on the 19th, overflowing a great extent of country below this city.

Shreveport, La.: rain, which fell at intervals after the 22d, and without interruption during the 25th and 26th, ended in sleet at 11.15 p. m., 26th. The Red River rose above the danger-line on the 26th and 27th, overflowing lowlands, driving some of the settlers out of their homes, and causing them to remove stock to the highlands.

HIGH TIDES.

Pysht, Wash., 7th.

Atlantic City, N. J.: owing to high northeasterly winds on the 5th and 6th, the tide rose very high on the latter date; much damage to property resulted.

New York City, N. Y.: the high tide at Coney Island on the 7th caused considerable damage to property.

Ocean City, N. J.: the severe northeast storm of the 5th and 6th caused the tide to rise very high on the 6th; washouts of about seven hundred feet occurred on the Ocean City branch of the West Jersey railroad, between this place and Sea Isle City; on the Sea Isle City Pleasure railroad, three hundred feet of Townsend's Inlet bridge were carried away.

Long Branch, N. J., 6th: most of the bulk-heads between Sea Bright and Monmouth Beach have been torn; the surf has inundated the streets of Sea Bright and caused much damage to property.

STAGE OF WATER IN RIVERS AND HARBORS.

In the following table are shown the danger-points at the various stations; the highest and lowest depths for January, 1889, with the dates of occurrence and the monthly ranges:

Heights of rivers above low-water mark, January, 1889 (in feet and tenths).

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
Red River:						
Shreveport, La.....	29.9	31	31.6	1	13.9	17.7
Arkansas River:						
Fort Smith, Ark ...	22.0	17	17.9	7,8	5.8	12.1
Little Rock, Ark...	23.0	19	21.2	8	8.7	12.5
Missouri River:						
Leavenw'rth, Kans.	20.0	1	4.7	18	3.2	1.5
Kansas City, Mo...	21.0	31	5.4	8	3.4	2.0
Mississippi River:						
Saint Paul, Minn*..	14.5	.....	.....	.....	.....	.....
La Crosse, Wis*...	24.0	.....	.....	.....	.....	.....
Dubuque, Iowa*...	16.0	.....	.....	.....	.....	.....
Davenport, Iowa...	15.0	9	2.0	1,2	0.6	1.4
Keokuk, Iowa	14.0	18	3.0	1	— 0.7	3.7
Saint Louis, Mo ...	32.0	20, 21	11.8	8	4.0	7.8
Cairo, Ill	40.0	22	31.0	6	14.8	16.2
Memphis, Tenn....	34.0	24	24.8	7,8	11.6	13.2
Vicksburg, Miss ...	41.0	28, 29	33.8	1	13.1	20.7
New Orleans, La ..	13.0	27	8.7	1, 15	6.3	2.4
Ohio River:						
Pittsburgh, Pa.....	22.0	29	13.2	22	4.4	8.8
Parkersburg, W.Va.	38.0	30	20.2	25	7.9	12.3
Cincinnati, Ohio ...	50.0	31	34.0	1	20.5	13.5
Louisville, Ky.....	25.0	31	12.3	1	8.0	4.3
Cumberland River:						
Nashville, Tenn ...	40.0	31	24.5	1	6.0	18.5
Tennessee River:						
Knoxville, Tenn...	29.0	7	7.0	4	2.3	4.7
Chattanooga, Tenn .	33.0	31	14.0	1	5.5	8.5
Monongahela River:						
Pittsburgh, Pa.....	29.0	29	13.2	22	4.4	8.8
Savannah River:						
Augusta, Ga	32.0	28	25.1	4	10.3	14.8
Willamette River:						
Portland, Oregon ..	15.0	24, 25	4.2	8, 15, 16	2.2	2.0

*Frozen.

ATMOSPHERIC ELECTRICITY.

AURORAS.

The only auroras reported were noted at Wedgwood, N. Y., 7th, and Saint Vincent, Minn., and Leech Farm, Dak., 1st and 20th. At Saint Vincent an auroral arch, first observed 7.45 p. m., 1st, ended during the night. The arch attained altitude 10° and covered 90° of the horizon. The display reached its maximum brilliancy at midnight.

THUNDER-STORMS.

Thunder-storms were reported during the month, by states and territories, as follows: 2d, 1; 4th, 2; 7th and 8th, 1; 9th, 4; 12th, 1; 13th, 4; 15th, 5; 16th, 13; 17th, 1; 19th, 1; 20th, 6; 21st, 4; 23d and 24th, 1; 27th and 30th, 1; 31st, 4. None were reported on the 1st, 3d, 5th, 6th, 10th, 11th, 14th, 18th, 22d, 25th, 26th, 28th, and 29th. Thunder-storms were reported in the several states and territories, by days, as follows: Ala., 3; Ariz., 2; Ark., 2; Fla., 7; Ga., 3; Ill. and Ind., 1; Ind. Ter. and Iowa, 2; Kans, 1; La., 5; Md., Mass., Mich., Miss., Mo., and N. J., 1; N. Y., 2; Oregon, 3; Tenn., 1; Tex., 10; Wash., W. Va., and Wis., 1. In Cal., Colo., Conn., Dak., Del., D. C., Idaho, Ky., Me., Minn., Mont., Nebr., Nev., N. H., N. Mex., N. C., Ohio, Pa., R. I., S. C., Utah, Vt., Va., Wis., and Wyo. no thunder-storms were reported.

Thunder-storms were reported in the greatest number of states and territories (13) on the 16th. On the 20th they were noted in 6, and on the 15th in 5.

They were reported on the greatest number of days (10) in Texas. In Florida they were noted on seven, and in Louisiana on five days.

MISCELLANEOUS PHENOMENA.

FOREST AND PRAIRIE FIRES.

Villa City, Fla.: forest fires to the east and southeast, 30th.
Fort Sill, Ind. T.: prairie fires, 2d to 6th, 9th, 11th, 18th, 19th.

HALOS.

Solar halos were most frequently reported in Illinois, where they occurred on nineteen days. In Dakota they were noted on eighteen days, in California and New York on twelve, and in Minnesota on eleven days. In Ala., Conn., Del., Ind. Ter., N. Mex., R. I., Utah, W. Va., Wyo., no solar halos were reported. They were reported in the greatest number of states and territories (18) on the 22d; in seventeen on the 4th; in fifteen on the 11th and 12th; and in thirteen on the 19th. There were no days during the month on which solar halos were not observed in one or more states or territories. The following is an extract from the report of the Iowa Weather Service for January, 1889: "The solar halo of the 11th formed a magnificent phenomenon in Montgomery and Adams counties. A vertical column of light preceded the rising sun on the 30th in southern Iowa county; a rather rare form of solar halo."

Lunar halos were most frequently reported in Kentucky and Tennessee, where they were noted on fourteen dates. In New